1,069,365

PATENT SPECIFICATION

DRAWINGS ATTACHED

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Int. Cl.:—G 01 n

COMPLETE SPECIFICATION

Improvements in or relating to Sclerometer Apparatus

I, SHIZUO IMAI, of 323, 2-chome, Sakasai, Edogawa-ku, Tokyo, Japan, a citizen of Japan, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a sclerometer apparatus for measuring hardness of a specimen.

In use of a Rockwell sclerometer, hardness of a test specimen is measured by applying a predetermined relatively light weight standard initial minor load to the test specimen by means of an indentation member which causes an indentation in the test specimen, and a reading of a pointer on a scale is taken. In a subsequent step, a heavy additional major load is applied on the same point by the same indentation member to cause additional depth of the indentation and the pointer is again read on the scale. Thereafter, the load is restored to the smaller initial standard minor load which caused the initial indentation and a third reading is taken. The difference between the first and third readings is a measure of the hardness of the specimen. The initial minor load penetrates the surface or outer skin and tests the surface hardness. The penetration measurement begins with the major load.

According to the present invention, there is provided sclerometer apparatus for measuring the hardness of a specimen, the apparatus comprising a platform adapted to receive the specimen, elevating means for elevating said platform, a motor and magnetic clutch unit mounted for driving said elevating means, an indentation member arranged to be capable of engaging the specimen when the latter is placed in position on said platform, a rod terminally carrying said indentation member, means for supporting said rod and for resiliently loading said rod, a pivoted lever engaged by a portion of said rod remote from said indentation member, an indicator assembly comprising a graduated dial and a pointer pivotally mounted to sweep over said dial, connecting means connecting said lever and said pointer for causing movements of said lever to rotate said pointer, lever switch means actuatable by displacement of said lever into an extreme position thereof, a photoelectric cell switch unit fixedly mounted with respect to said dial, and comprising a light source and a photoelectric cell spaced from said light source, a mask pivotally mounted for rotation around said dial in synchronism with said pointer and for passing during rotation between said light source and said photoelectric cell when said pointer is in registry with the zero graduation on said dial, a control circuit comprising said lever switch means and said photoelectric cell switch unit, and relay means connected for actuation by said control circuit and adapted to de-energise and stop movement of said motor and clutch unit when said control circuit is actuated.

For a better understanding of the invention, and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:—

Fig. 1 is a side elevational view, partly in section, of an embodiment of a sclerometer according to the present invention;

Fig. 2 is a front elevation view corresponding to Fig. 1;

Fig. 3 is a side view, partly in section, of a detail of the embodiment illustrated in Fig. 1;

Fig. 4 is a sectional side view of a further detail of the embodiment illustrated in Fig. 1;

Fig. 5 is a front view of a further detail of the embodiment of Fig. 1;

Fig. 6 is a partially schematic sectional side view, drawn to a larger scale, of a detail of Fig. 4; and

Fig. 7 is an electric circuit diagram of the

[*Price 4s. 6d.*]

circuit employed in the embodiment of Fig. 1.

In Fig. 1, the numeral 1 denotes a machine frame which has on its front surface and at a lower portion thereof a projecting base casing 2 and at the upper portion thereof a projecting head casing 3. A threaded rod 6 is screwed into a threaded tubular body 5 provided in an upper plate 4 of the base casing 2, the rod 6 being also threaded through a threaded circular aperture in the centre of a gear 7. The threaded rod 6 is provided on its peripheral surface with a longitudinal groove 8, and a guide piece 9, (Fig. 3) projecting from the inner wall of the tubular body 5, is engaged by the groove 8 so that the threaded rod 6 may be given upward and downward movement in accordance with the rotation of the gear 7.

A clutch disc 12, which is in magnetic relation to an electro-magnetic clutch 11, is caused to rotate by said clutch 11. An electric motor 10 provided outside the tubular body 5, drives the clutch 11. A gear 14, mounted on a rotatable shaft 13 of said clutch disc 12, is in mesh with the gear 7 on the rod 6 for drivingly rotating said gear 7. The test specimen receiving table 15 is provided at the top surface of the threaded rod 6, and a test specimen 16 to be tested is placed on and held by the table 15.

A pressing push rod 18 (Figs. 1 and 4), which carries at its lower end an indentation member 17 of diamond, or a steel sphere or other similar member, above the upper surface of the test specimen 16, is provided within the head casing 3, and the punch member 17 is urged downwardly against shoulders formed in the head casing 3 by a spring 20 which is supported at its upper end by a holding member 19. When the test specimen 16 is pushed upwardly, by the raising of the table 15 by the threaded rod 6, and engages the indentation member 17, the indentation member 17 is pushed upwardly against the action of the spring 20. Then a lever 21, which is provided above rod 18, is tilted about a pivot 22, on which it is mounted, by the upper end of the pressing rod 18 whereby due to a relative movement translation apparatus 23, which is connected to one end of the lever 21, a pointer 25 on a dial plate 24 is rotated about its pivot 26. The pointer 24 can rotate around the dial plate more than once. The dial plate 25 has on its surface a scale 27 (Figs. 2 and 5) surrounding the pivot 26 of the pointer 25. When the test specimen 16 is pushed upwardly after being pressed against the indentation member 17 and is loaded thereby, the pointer 25 is therefore rotated over the scale 27 and indicates magnitude of the vertical displacement of indentation member 17 and the hardness of the specimen.

Below the end of the lever 21 remote from the movement translation apparatus 23, there is provided an electric switch 28 which is designed and mounted to be normally open, and only to be closed when the indentation member 17 approaches its uppermost extreme position at which the light standard initial minor load is to be applied.

Further, a light mask 29, (Figs. 4, 5 and 6) is attached fixedly to the pointer 25 on the opposite side of the dial plate 24. On opposite sides of the path of mask 29 there are provided a light source 30 and a photoelectric cell resistance element 31 which is operable by said light source 30, so that as soon as the shielding mask member 29 which rotates in synchronism with the pointer 25, reaches a point between the light sources 30 and the photoelectric resistance element 31, and intercepts a beam of light projected from the light source 30 to the photoelectric resistance element 31, said element is actuated to open its controlled circuit, which is described in more detail below. Thus, a switch is provided which does not require mechanical movement.

The element 31 is mounted in such position that when the pointer 25 indicates the zero mark of the scale 27, (see Fig. 5), the shielding mask member 29 is located at the shielding position between 30 and 31. When this photoelectric resistance element 31 is actuated by the switch 28 being closed by the lever 21, the actuating circuits of both the electric motor 10 and the electromagnetic clutch 11 are cut off by the action of a relay control system for immediately stopping the operation of motor 10 and clutch 11. Accordingly at the uppermost extreme position of the pressing indentation member 17, the pointer 25 will be stopped to coincide exactly with the zero graduation point of the scale 27.

These operations will be explained with reference to the circuit diagram of Fig. 7.

A manual starting push button switch 32 is first closed after placing the test specimen 16 on the table 15, (Fig. 1) and this causes a magnet relay 33 to be energised for respectively closing motor switches 34 and 35 in the driving circuits of motor 10 and energising magnet clutch 11 as well as a self-holding switch 36, whereby the motor 10 and the clutch 11 operate to screw the threaded rod 6 (Fig. 1) upwardly. By this upward movement, the test specimen 16 is pressed against the pressing indentation member 17 positioned thereabove and this tilts the lever 21 (Fig. 1) by the indentation member 17, and thereby the pointer 25 (Figs. 2 and 5) is caused to rotate over the scale 27 by the action of the relative movement translating apparatus 23, (Fig. 4).

By the time the pointer 25 has been rotated around the dial three times, the test specimen 16 is loaded with a load nearly equal to the desired standard initial minor load and the

indentation member 17 approaches its uppermost extreme position. The switch 28 (Fig. 1) is then closed by application thereupon of the other end of the lever 21. When the pointer 25 (Fig. 5) during its rotation passes over the zero mark of the scale, the mask 29, (Fig. 5) which rotates synchronously therewith, intercepts the light beam from the light source 30 to the photoelectric cell resistance element 31. However during the rotation of the pointer for the first two times around, the system comprising photoelectric resistance element 31 and the switch 28 (Fig. 1) operatable by the other end of the lever 21, does not actuate its controlled circuit, because the switch 28 has not been engaged by the lever 21 to move the switch to its closed position. In the third rotation of pointer 25 over its scale, that is, when the pressing punch member 17 approaches its uppermost extreme position, to operate the switch 28 to its closed position the photoelectric resistance element 31 is covered by the mask 29, and then the element 31 and the switch 28 closes a circuit for operating a relay discharge tube 37.

Thereby a magnet relay 38 is operated for opening a stop switch 39, and the circuit of the winding of control magnet relay 33 is opened to restore the switches 34, 35, 36 to their initial condition, whereby the energisation of the motor 10 and the clutch 11 are stopped, and the upward movement of the threaded rod 6, (Fig. 1) is stopped exactly at that position for stopping the rotation of the pointer 25, and accordingly the pointer 25 is stopped at the position where it indicates exactly the zero mark of the scale 27 (Fig. 5).

After the pointer 25 has been stopped at the zero position under the condition where the standard initial minor load has been applied, in the next step, a lever 41 (Fig. 1) is lowered by being released by suitable control means from being supported by a supporting member 40 to add an additional major load to indentation member 17 by a weight 42 hung down on one end of the lever 41, and indentation member 17 is driven deeper into the interior of test specimen 16.

Then, in the next step, the additional major load is removed by again raising supporting member 40 so that the pointer 25, by the position it then occupies under the influence of the initial minor load, indicates the hardness of the test specimen 16 on the scale 27.

Thereafter, manual switch 43, (Fig. 7) is opened to cut off the actuating circuit of the relay discharge tube 37 and the magnet relay 38.

If manual switches 44 and 45 (Fig. 7) are closed after the stop switch 39 is restored to normal position, a reverse rotation drive circuit for the motor 10 is constituted and at the same time the circuit for energizing the electromagnetic clutch 11 is closed, whereby the threaded rod 6, (Fig. 1) may be lowered for removing the test specimen 16 from the pressing indentation member 17 to install a new test specimen. Numeral 46, (Fig. 7) denotes a densitivity controlling potentiometer device for the relay discharge tube 37.

The present invention has the advantages that it can be operated very accurately to stop automatically the pointer at the position where the same indicates exactly the zero point of the scale, and an accurate hardness measurement can be carried out more easily and effeciently in comparison with the conventional method where a dial plate is rotated to the stop position of a pointer for setting the zero point.

It will be realised that the present invention is capable of modifications for adaptation to particular conditions, and all such modifications which are within the scope of the accompanying claims are considered to be comprehended within the scope of the present invention.

WHAT I CLAIM IS:—

1. Sclerometer apparatus for measuring the hardness of a specimen, the apparatus comprising a platform adapted to receive the specimen, elevating means for elevating said platform, a motor and magnetic clutch unit mounted for driving said elevating means, an indentation member arranged to be capable of engaging the specimen when the latter is placed in position on said platform, a rod terminally carrying said indentation member, means for supporting said rod and for resiliently loading said rod, a pivoted lever engaged by a portion of said rod remote from said indentation member, an indicator assembly comprising a graduated dial and a pointer pivotally mounted to sweep over said dial, connecting means connecting said lever and said pointer for causing movements of said lever to rotate said pointer, lever switch means actuatable by displacement of said lever into an extreme position thereof, a photoelectric cell switch unit fixedly mounted with respect to said dial, and comprising a light source and a photoelectric cell spaced from said light source, a mask pivotally mounted for rotation around said dial in synchronism with said pointer and for passing during rotation between said light source and said photoelectric cell when said pointer is in registry with the zero graduation on said dial, a control circuit comprising said lever switch means and said photoelectric cell switch unit, and relay means connected for actuation by said control circuit and adapted to de-energise and stop movement of said motor and clutch unit when said control circuit is actuated.

2. Sclerometer apparatus as claimed in claim 1, wherein the elevating means for elevating said platform comprises an externally threaded rod at the upper end of which is said platform, a gear wheel engaging the

thread of said threaded rod, and further gear means connecting said gear wheel with said motor and clutch, the threaded rod being guided for vertical displacement in the machine frame of the apparatus.

3. Sclerometer apparatus as claimed in claim 1 or 2, wherein said mask and said photoelectric cell are arranged on the opposite side of said dial to said pointer.

4. Sclerometer apparatus for measuring the hardness of a specimen, substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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from which copies may be obtained.

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3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

FIG. 2

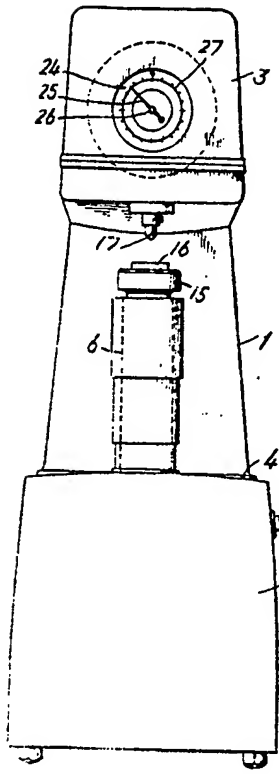


FIG. 1

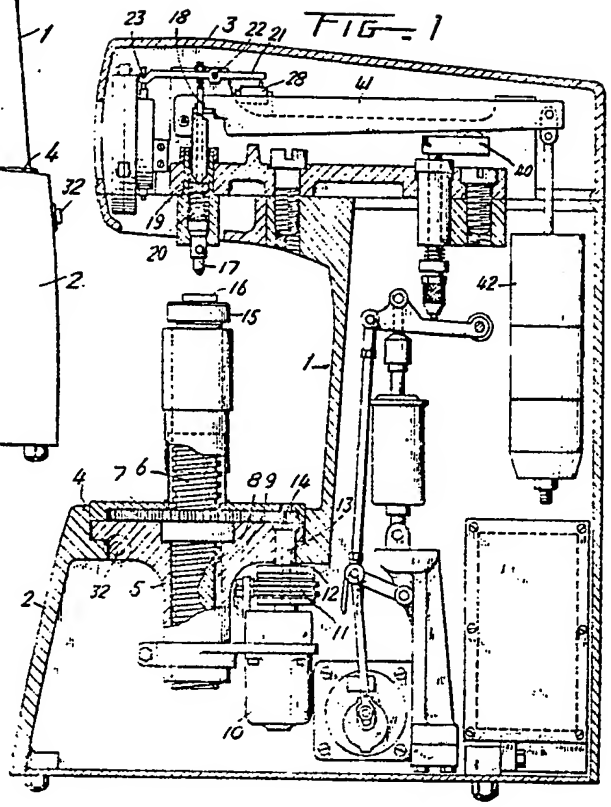


FIG-3

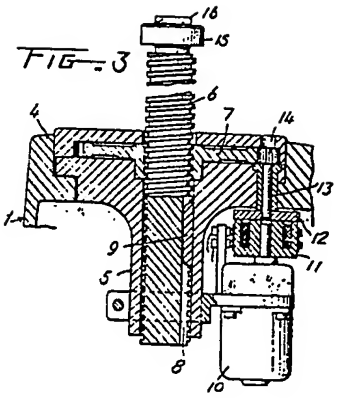
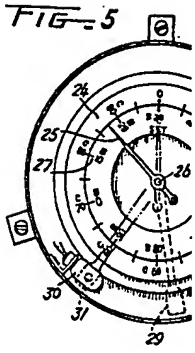


FIG-5



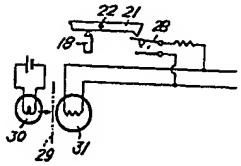
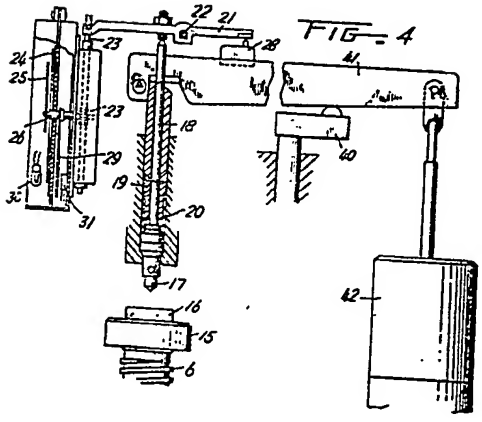
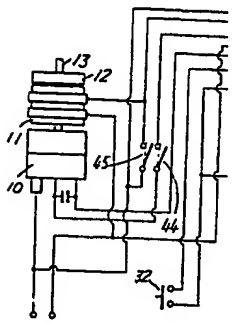


FIG-4





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3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheets 2 & 3

FIG. 3

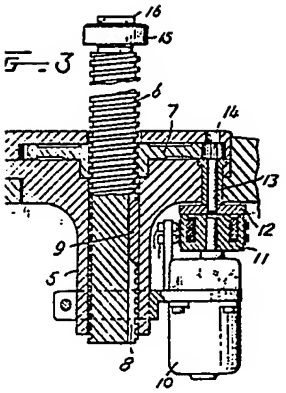


FIG. 5

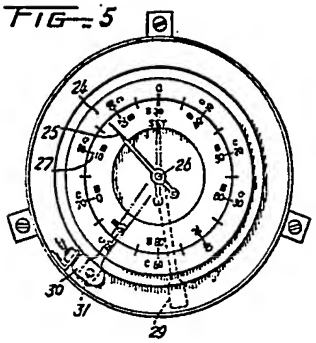


FIG. 6

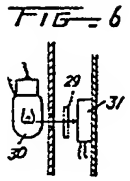


FIG. 4

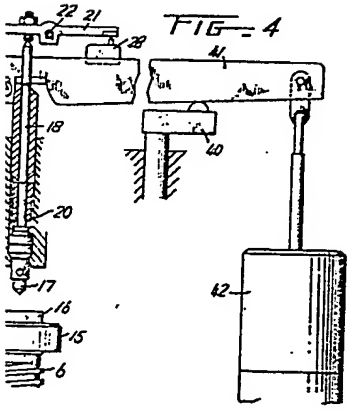
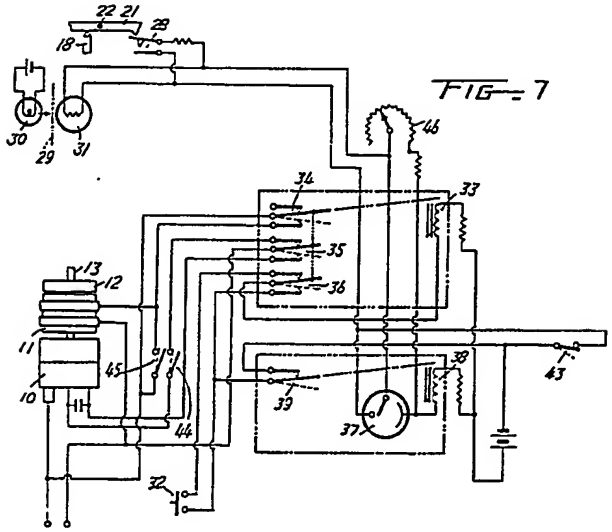


FIG. 7



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Sheets 2 & 3

FIG. 3

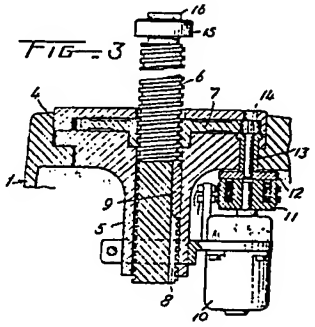

FIG. 5

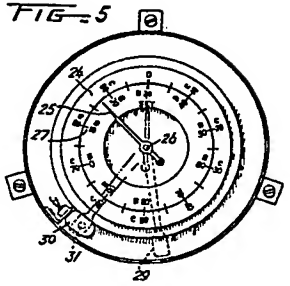

FIG. 6

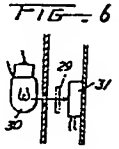

FIG. 4

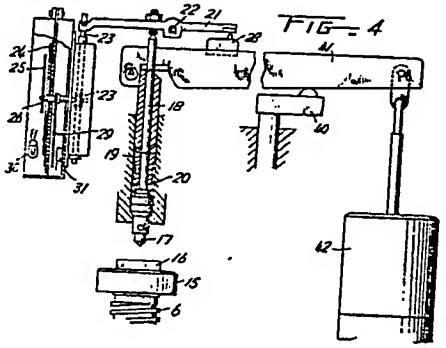

FIG. 7